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# Backlash and Challenges Faced by Pakistani Women Who Harbor an Interest in STEM Education

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**Abstract**

The rapid shift in technology after globalization left its impact on every domain including education. In such advanced times, the need to acquire STEM education has become more imperative due to its vast real-world applicability. STEM education refers to acquiring knowledge and learning in the subjects of Science, Technology, Engineering and Mathematics. Although, STEM education is gaining traction world-wide through a blend of formal, informal, national, and private–sector; but there is still a visible gender disparity in attaining STEM education, specifically for girls. This disparity is even more pronounced in developing and under-developed countries. Due to limited scope of this paper we will narrow down our research to the region of Pakistan. This essay will unveil the challenges that women have to endure if they want to pursue STEM subjects. Secondly, it will examine the factors that contribute in gender disparity while choosing STEM subjects. In addition, the essay aims to seek possible solutions to bridge this gender gap by breaking the stereotypes. Lastly, we shall explore future prospects of STEM education in Pakistani region followed by closing arguments. This study will also enumerate Judith Butler's theoretical contributions in the second and third sections in comprehending how gender roles are shaped by society and culture in Pakistan. Moreover, the essay will also critically evaluate Butler's work on the grounds that whether her post-cultural theory is applicable to Pakistani educational System or not.

**Keywords:** STEM education, theory of performativity, post-cultural theory, Pakistani Women

## Introduction

Globalization amidst the information era has revolutionized education and learning.[1] STEM (Science, Technology, Engineering and Mathematics) education has become an essential demand to meet economic needs and progress. Studies have shown that despite so many collaborative international efforts, there appears to be a significant STEM divide[2]; and women are still under-participating in STEM fields making only 28% of the overall world's female population as per

[1]Anthony Giddens, *Runaway World: How Globalization is Reshaping Our Lives* (Routledge, 2002).
[2]Giddens, *Runaway World: How Globalization is Reshaping Our Lives*.

year 2023.[3] Similarly, South Asian countries further lag behind Western nations in trying to bridge the gender gap in STEM subjects.[4] This is a serious concern not merely for western countries but also for the eastern countries. However, due to certain limitations, this study on the gender gap in choosing STEM subject has been narrowed down to the region of Pakistan.

While, the literacy rate of Pakistan is 59%; and the preference of male education over female education further aggravates the problem.[5] Following the foot-steps of developed nations, Pakistani education system is paving a way to bridge the gender gap in STEM education.[6] The main focus of this paper will be to expound the challenges faced by female population of Pakistan who harbor interests in STEM subjects yet they don't pursue it. Studies from OECD shows that the percentage of women graduates in STEM subjects are far less as compared to men.[7]

People in Pakistan have stereotyped women even in education and career choices. They are of the view that women ought to be either teachers or doctors on the presumption that those two are the only respectful careers for women.[8] Hence, since early childhood girls are trained to choose either medical field or some major subject to become a teacher in the future.[9] Those girls who show signs of interests in STEM subjects are often suppressed[10] either with the stereotypical brainwashing or sometimes vehemently as well to crush their dreams and goals.[11]

According to a collaborative research conducted by *British Council*, "Negative stereotypes, social and peer pressure a lack of encouragement and the perceived marginalization of women who work in STEM fields have all been identified as factors that discourage young women from

[3]Clara Piloto, "The Gender Gap in STEM|MIT Professional Education," *MIT Professional Education*, 2023, https://professionalprograms.mit.edu/blog/leadership/the-gender-gap-in-stem/; "National Report on the Status of Women in Pakistan, 2023," *UN Women: Pakistan, United Nations Entity for Gender Equality and Empowerment of Women* (2023), https://pakistan.unwomen.org/sites/default/files/2023-07/summary_-nrsw-inl_final.pdf [Accessed 1 Apr. 2024].

[4]R. N. Awan, M. Sarwar, M. Mehdi, Ghazala Noureen and N. Anwar, "Interests and Recruitment in Science: Factors Influencing Recruitment and Retention in STEM Education at University Level in Pakistan," *Bulletin of Education and Research* 39 (3), (2017): 19–43.

[5]J. Lindner, "Must-Know Pakistan Education Statistics." *Pakistan Education Statistics* 2023, https://gitnux.org/pakistan-education-statistics/ [Accessed 31 Mar. 2024].

[6]S. Hollows, M. Rab, and C. Schulze, "Understanding Female Participation in STEM Subjects in Pakistan," *9th annual International Conference of Education, Research and Innovation* Seville, *ICERI Proceedings*, 2016, https://doi.org/10.21125/iceri.2016.2006.

[7]Hollows, M. Rab, and C. Schulze, "Understanding Female Participation in STEM Subjects in Pakistan."

[8]Sadaf Sarfraz, "The STEM Gap — Contribution of Women in Science and Technology in Pakistan," *Scientia Magazine* (2023), https://scientiamag.org/the-stem-gap-contribution-of-women-in-science-and-technology-in-pakistan/ [Accessed 27 Mar. 2024].

[9]Natalia Ayuso, Elena Fillola, Belen Masia, Ana C. Murillo, Raquel Trillo-Lado, Sandra Baldassarri, Eva Cerezo, Laura Ruberte, M. Dolores Mariscal, Maria Villarroya-Gaudo, "Gender Gap in STEM: A Cross-Sectional Study of Primary School Students' Self-Perception and Test Anxiety in Mathematics," *IEEE Transactions on Education* 64 (1), (2021): 40–49. https://doi.org/10.1109/te.2020.3004075.

[10]UNESCO, "National Dialogue on Women in Science - Pakistan." 2020. https://en.unesco.org/events/national-dialogue-women-science-pakistan [Accessed 27 Mar. 20124].

[11]See Maryam Salman, "The Gender Gap in STEM: Challenges and Opportunities in Pakistan," October 26, 2023, Available at: https://medium.com/@maryam.salman70/the-gender-gap-in-stem-challenges-and-opportunities-in-pakistan-e8665028c94e [Accessed 27 Mar. 2024]; Myra Ahsan, "Less than 10% Women in STEM in Pakistan: Gender Stereotypes or Choice?" *Voicepk.net.* (2022) Available at: https://voicepk.net/2022/05/less-than-10-women-in-stem-in-pakistan-gender-stereotypes-or-choice/ [Accessed 27 Mar. 2024].

pursuing careers in science"[12] The current study may use pre-existing reports and surveys to support arguments wherever deemed essential.

## 2. Addressing the Stem Divide in Pakistan

Pakistan is a population of 241.49 million with 123.6 million males and 121.62 million females.[13] According to data generated by Education for All's Development Index (EDI), Pakistan stood at 130th position out of 146 countries with overall literacy rate at 59% (71% men and 48% women).[14] The disparity further increases when compared to rural areas of Pakistan where women are not enrolled in even non-STEM education. Thus, their basic right to education is violated. It is worth pondering that women constitutes almost half of the population of Pakistan, therefore, their contribution in the country is very essential for socio-economic progress. In addition, economy crisis and decline in productivity calls for women contribution in Pakistan.

In this regard, government of Pakistan and organizations are trying to eradicate educational hurdles for women so that they too can have equal opportunities to acquire education.[15] In the 21st century, the rapid advances in technology lead to globalization; and the tech-world is proceeding towards a universal global culture. Therefore, education in tech-subjects like STEM is associated with major economic progress and flourishing future outputs.[16] Unfortunately, due to predetermined gender roles by Pakistani society and culture, a woman who favors STEM subjects have to face backlash.[17] As a result, the participation of Pakistani women in STEM education is less than 10%.[18] Among these 10%, major proportion opt science subjects mainly in terms of MBBS, while a minor proportion opt Math's, Engineering and Technology.

It's a common generalization in Pakistan that women are epitome of femininity, modesty and grace. Society expects from women to be submissive, weak, socially and economically dependent on their fathers or spouses; and should perform domestic chores and rear children efficiently. Thus, any opposition or refusal of women to comply with these boundaries is severely backlashed as modernist and feminist (in negative sense); home-breakers and characterless.[19] It is sorry state to say that women lives revolve around these set of rules whether it's the issue of honor killing, love marriage, rights to education or matter of divorce and custody of children. Any woman who raises voice for her rights is considered a threat to cultural and religious institutions. So, men in their own families, religious clerics and men within society felt duty-bound to break women spirit, confidence and dreams. Hence, the problem of STEM divide is associated with stereotypes that

[12]Hollows, M. Rab, and C. Schulze, "Understanding Female Participation in STEM Subjects in Pakistan."

[13]WorldOMeter, "Pakistan Population (2019) – Worldometers." *Worldometers.info*. 2020, https://www.worldometers.info/world-population/pakistan-population/.

[14]J. Lindner, "Must-Know Pakistan Education Statistics." *Pakistan Education Statistics* 2023, https://gitnux.org/pakistan-education-statistics/ [Accessed 31 Mar. 2024].

[15]"National Report on the Status of Women in Pakistan, 2023," https://pakistan.unwomen.org/sites/default/files/2023-07/summary_-nrsw-inl_final.pdf.

[16]S. Hollows, M. Rab, and C. Schulze, "Understanding Female Participation in STEM Subjects in Pakistan."

[17]Muhammad Ali Shaikh, Zahid Hussain Sahito, and Mahboob Ali Dehraj, "Stem Education: Social, Cultural, and Economic Barriers Faced by Women of Khairpur (Pakistan)," *Global Regional Review* IV (II), (2019): 392–403. https://doi.org/10.31703/grr.2019(iv-ii).42.

[18]Myra Ahsan, "Less than 10% Women in STEM in Pakistan: Gender Stereotypes or Choice?" *Voicepk.net.* (2022)

[19]Shaikh, et.al., "Stem Education: Social, Cultural, and Economic Barriers Faced by Women of Khairpur (Pakistan)," 392-403.

are deep-rooted in culture,[20] so it would require thorough cleansing to eradicate it fully. Only by terminating the STEM divide, Pakistan can pave a way for economic and social progress.[21] A process that would take a decade if due measures are taken today.

## 3. Analyzing the Key Challenges That Contributes in Persisting Gender-Gap While Opting Stem Education by Using Butler's Theory

Judith Butler's theory of performativity can be used to provide a framework through which the prevailing cultural norms can be studied and analyzed in Pakistan that has shaped women attitude towards STEM education. Limited access to education, cultural stereotypes, misuse of religion to endorse stereotyping, pre-ordained social mindset affects decision-making and career setback are some inter-related challenges that played an important role in maintaining a gender gap in STEM education.

Surveys and studies shows that females in Pakistan, in spite of having aptitude, have limited access to education due to various reasons including: financial barriers, early marriages, stereotyping women to stay at home etc.[22] Pakistani government is paving a way to implement gender equality in every sphere of life within the country. Unfortunately, it still lacks to implement sustainable development goals, due to investing only 2.9% GDP on education.[23] A recent research has shown that the progress in eliminating STEM divide is extremely slow due to lack of resources and no viable strategy by ministry of education.[24]

Pakistani culture is a mixture of Indo-Arabic culture. The role of women is stereotyped as home-makers so they have limited access to education. Majority of women are not allowed to complete their education; and even if they do they are discouraged to opt STEM subjects. STEM subjects are gendered and associated with masculinity.[25] In addition, women are also considered inferior or soft minded (unintelligent) to study hard subjects like STEM.[26]

According to Butler, gender norms are neither natural nor innate rather they are performed and repeated to the extent where they are internalized within a society. In her book *Gender Trouble*, she states that: "The subject is not determined by the rules through which it is generated because signification is not a founding act, but rather a regulated process of repetition that both conceals itself and enforces its rules precisely through the production of substantializing effects."[27]

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[20]Silvia Galdi, MaraCadinu, and Carlo Tomasetto, "The Roots of Stereotype Threat: When Automatic Associations Disrupt Girls' Math Performance," *Child Development* 85 (1), (2013): 250–263. https://doi.org/10.1111/cdev.12128.

[21]Piloto, "The Gender Gap in STEM|MIT Professional Education," https://professionalprograms.mit.edu/blog/leadership/the-gender-gap-in-stem/

[22]Boni Wozolec, "Race, Gender, and Sexual Orientations in Curriculum," *Oxford Research Encyclopedia of Education, (November 19, 2020),* Retrieved 21 Jun. 2024). https://doi.org/10.1093/acrefore/9780190264093.013.1445

[23]"National Report on the Status of Women in Pakistan, 2023," https://pakistan.unwomen.org/sites/default/files/2023-07/summary_-nrsw-inl_final.pdf.

[24]Ali Usman Hali, Sarfraz Aslam, Bao Hui Zhang, and Atif Saleem, "An Overview on STEM Education in Pakistan: Situation and Challenges," *International Transaction Journal of Engineering, Management, and Applied Science and Technologies* 12 (1), (2020): 1–9, http://tuengr.com/V12/12A1T.pdf, https://doi.org/10.14456/ITJEMAST.2021.20

[25]Silvia Galdi, MaraCadinu, and Carlo Tomasetto, "The Roots of Stereotype Threat," 250–263.

[26]Maryam Salman, "The Gender Gap in STEM: Challenges and Opportunities in Pakistan," https://medium.com/@maryam.salman70/the-gender-gap-in-stem-challenges-and-opportunities-in-pakistan-e8665028c94e, [Accessed 27 Mar. 2024]; Myra Ahsan, "Less than 10% Women in STEM in Pakistan: Gender Stereotypes or Choice?" *Voicepk.net.*

[27]Judith Butler, *Gender Trouble: Feminism and the Subversion of Identity* (London: Routledge, 1990), 179.

As a result, the small percentages that do harbor interest in STEM subjects are challenged by their own families, communities or religious institutions. Breaking free from cultural prejudices and convincing their families is a battle on two-front which is rarely won in Pakistani women favor.

It is also debatable that Muhammad Ali Jinnah (1876-1948), the father of Pakistan, emphasized on women education. His own sister, Fatima Jinnah and many other females has participated in the struggle of independence. This entails that restricting women roles within a society is born from patriarchal mind-set.

Cultural stereotyping of gender roles is embedded within society by supportive religious arguments that men are bread-winners while women ought to stay indoors as they are care-takers.[28] In fact religion is often used as a conclusive argument in determining or rather enforcing gender roles.[29] However, this is a misconception as Islam promotes not only equality among genders, but also advocates for education for both males and females.[30] Muslim women are known to be educated and independent in decision making. For instance, Ayesha (RA) is known for her knowledge of history and medicine; Khadija (RA) was a business women.[31] In Similar vein, domestic roles were not gendered based in Islam. We can find many incidents from the life of the Prophet Muhammad (PBUH) where he used to perform household tasks; and he (PBUH) has always valued the opinions of his wives.[32] To sum up, prophet (PBUH) has encouraged and acknowledged women participation within society, politics, social and economic affairs as well as in military sections.[33] Additionally, Islam does not load in-laws responsibility on women. The reason behind misuse of religion is merely to justify patriarchal injustice within society that has been the byproduct of Indian culture. However, due to word limitation, we cannot explore this area in detail.

In the past three decades, Pakistan has endeavored to increase the literacy rate among females. However, while choosing subjects women are either trained or else forced to opt soft subjects (like home-economics, arts, literature etc.) on the basis of stereotyping women career and roles. Since my childhood, it has been ingrained in my mind that the only respectable professions for women are either doctors or teachers. Even as a doctor, one can witness a gender disparity while choosing specialization. For e.g., female doctors are preferred as a gynecologists, medical specialists, child-specialist, psychiatrists or dermatologists etc.; whereas, male doctors are to choose being surgeons, radiologists, anesthetist etc. There is hardly any evidence of switched professions in aforementioned roles. Butler's theory of performativity is applicable here as well where gender roles are made via continuous repetition of experiences develops a certain mind-set. In this case,

[28]Judith Butler, Jürgen Habermas, Charles Taylor, Cornel West, Edurado Mendieta, Jonathan Vanantwerpen, and Craig Calhoun, *The Power of Religion in the Public Sphere* (Columbia University Press, 2011).

[29]Judith Butler, Jürgen Habermas, et.al., *The Power of Religion in the Public Sphere*.

[30]Farah Khan, Shagufta Gul, and Sadia Naz, "Islam and Women's Rights of Education: Mandatory or Forbidden," *Pakistan Journal of Humanities and Social Sciences Research*, 3 (01), (2020): 13–22, https://doi.org/10.37605/pjhssr.3.1.3.

[31]Farah Khan, Shagufta Gul, and Sadia Naz, "Islam and Women's Rights of Education: Mandatory or Forbidden," 13-22.

[32]Shaykh Muhammed bin Alawi al Maliki, *Muhammad the Perfect Man*, trans. Khalid Williams (Reality Books, 2016), https://dn721800.ca.archive.org/0/items/perfect-compressed/Perfect_compressed.pdf

[33]Tariq Ramadan, *In the Footsteps of the Prophet: Lessons from the Life of Muhammad* (Oxford University Press, 2009), 214.

the false yet preconceived notion that women are not of strong mind and do not have enough focus to study STEM subjects; let alone make a career out of it.[34] Hence, due to pre-ordained mind-set, girls in schools underperformed in mathematics and science subjects while excelling in other subjects. This is because of the fear that the gender of women necessitates failure in STEM fields.[35] Therefore, very little population of adult females opt engineering and technology fields. And even fewer among those make a career out of it while the rest preferred to be housewives after obtaining degrees.

Another challenge faced by the women who are interested in STEM subjects are that they face an unconscious bias while hiring or promotions etc.[36] For instance, a female engineer or anesthetist will never be preferred over males while hiring for same job posts. Organizations and tech-offices in Pakistan have very few percentage (probably of 1:10) of STEM women workers.[37] This small ratio also complained of gender biasedness while promotions in addition to facing harassment and gender pay gap.

One of the major hurdle in opting STEM subjects as a career is that most often these jobs are too demanding and require over-time. Thus, balancing home and work-life can becomes too tough for women. A data-analyst who has worked for a Dubai-based company in Pakistan for seven years had to eventually quit her dream job because of unbearable pressure to balance work and home.[38] Much of the pressure often comes from in laws, since Pakistani society have established this fact that women alone have to do domestic chores at home as well as is solely responsible to up bring children. So, even if she is career-oriented, she has to fulfill and excel in both her work and home life. And even if it ever comes to sacrifice ones career, it should be always a woman's sacrifice. According to Butler, performative acts stereotype gender roles.[39] Failing to comply with these roles and boundaries set by culture and society will lead to social stigmas. Due to all these unrealistic cultural expectations from women not only discourage them to pursue their educational dreams and aspirations, but also rendered their performance level even if they do in fact pursue them.

## 4. Solutions to Encourage and Cultivate Women Interest in Stem Education

Regulating scholarships and financial support, awareness campaigns, rethinking pedagogical practices in early childhood education, inspiration from female role models, innovation summits, STEM-focused institutes and rigorous research in STEM are few suggestions that can enhance women interest and motivate them to acquire STEM education. In the past three decades, many middle and lower class families want to educate their children. However, due to financial issues they are compelled to drop girls after primary. In addition, male education is on top-priority as he is considered as the future breadwinner of the family. This entails that gender disparity within education can be minimized if financial needs are met. The ministry of education should award

[34]Awan et.al, "Interests and Recruitment in Science," 19–43.
[35]Butler, *Gender Trouble: Feminism and the Subversion of Identity* 150-185.
[36]Maryam Salman, "The Gender Gap in STEM: Challenges and Opportunities in Pakistan."
[37]Hollows, M. Rab, and C. Schulze, "Understanding Female Participation in STEM Subjects in Pakistan."
[38]Due to confidentiality, the name of the interviewee has not been mentioned here.
[39]Judith Butler, *Gender Trouble: Feminism and the Subversion of Identity*, 150-185.

scholarships to females, so no one has to leave education because of financial barriers.[40] Furthermore, those women who excel in their fields and show aptitude for STEM should aid with governmental and non-governmental grants to support them financially for higher education.

Moreover, reserved quotas for females in all STEM educational institutes and organization will enhance female enrollment and career pathways in STEM related fields. To implement these changes, government of Pakistan seriously needs to enhance its budget on education.

Campaigns to spread awareness among teachers, students and parents are required to change their mind-set.[41] A study shows that there is a downward trend towards enhancing STEM awareness.[42] Government should seek help from national and international NGO's along with educational ministry of Pakistan to carry out workshops, seminars, networking events, conferences and counselling sessions to convince them the importance of STEM subjects. Moreover, specially designed research and plan is needed to break free from preexisting stereotypes that are root cause of the problem.[43] Butler suggested in similar vein that women are not merely the reflection of their culture.[44] Efforts should be made to engage parents and spouses to alter their mind-set regarding career-oriented women.[45]

Likewise, educators need to be trained according to gender sensitivity in order to implement teaching strategies to combat prejudices. Their method should include an inclusive learning environment in the class for all students regardless of their sex.[46]

Although Pakistani government is already taking initiatives to provide equal educational opportunities for women, however in order to enhance interest in STEM subjects they have to make changes in the educational policies and current curriculum as well starting from the early age.[47] This is because almost all Pakistani textbooks stereotyped women as homemakers and caregivers. Their economic and nation-building contribution is completely ignored.[48] Teachers teach those subjects by ingraining the same ideals among women. This not only creates a negative mindset towards STEM subjects,[49] but also the illogical preconceived notion that an independent and career oriented woman is too modern, morally corrupt or unfit as a wife. Hence, Pakistan needs a gender-sensitive pedagogical approach and a revised curriculum that not only challenges

[40]Maryam Slaman, Empowering Women in STEM: Programs and Community Outreach Initiatives in Pakistan," October 2023.

[41]Eliane Davila Dos Santos, Alberto Albahari, Soledad Díaz, and Ernani Cesar De Freitas, "Science and Technology as Feminine': Raising Awareness about and Reducing the Gender Gap in STEM Careers," *Journal of Gender Studies* 31 (4), (2021): 1–14. https://doi.org/10.1080/09589236.2021.1922272.

[42]Sarfraz Aslam, Atif Saleem, Teresa J. Kennedy, Tribhuwan Kumar, Khalida Parveen, Huma Akram, and B BaoHui Zhang, "Identifying the Research and Trends in STEM Education in Pakistan: A Systematic Literature Review," *SAGE Open* 12 (3), (2022): 1-16. https://doi.org/10.1177/21582440221118545.

[43]Eliane Davila Dos Santos et.al, "Science and Technology as Feminine," 1–14.

[44]Judith Butler, *Gender Trouble: Feminism and the Subversion of Identity*, 182.

[45]Sadaf Sarfraz, "The STEM Gap — Contribution of Women in Science and Technology in Pakistan," https://scientiamag.org/the-stem-gap-contribution-of-women-in-science-and-technology-in-pakistan/

[46]Ayuso et.al, "Gender Gap in STEM: A Cross-Sectional Study of Primary School Students' Self-Perception and Test Anxiety in Mathematics," 40–49.

[47]Piloto, "The Gender Gap in STEM|MIT Professional Education," https://professionalprograms.mit.edu/blog/leadership/the-gender-gap-in-stem/.

[48]Myra Ahsan, "Less than 10% Women in STEM in Pakistan: Gender Stereotypes or Choice?" *Voicepk.net.* (2022).

[49]Ayuso et.al, "Gender Gap in STEM: A Cross-Sectional Study of Primary School Students' Self-Perception and Test Anxiety in Mathematics," 40–49.

stereotypes; but also provides a platform where the women are seen actively participating in nation-building as well.[50] Pakistani history is filled with strong-willed women but they are rarely discussed in textbooks[51]; and if so then all too briefly for students to get inspiration from them.

Since very few women pursue STEM, there are finite numbers of role models. As mentioned earlier, gender-sensitive curriculum that acknowledges contribution of women in politics, economy, Islam, and STEM subjects should be introduced so that young girls can gain inspiration from their stories. Furthermore, discussing their journey and hardships behind that success can encourage them to elevate from their own challenges and achieve their goals.[52]

Furthermore, Electronic media and social media can also take initiatives to celebrate the success stories of women who excel in STEM fields against all odds. They should enumerate stories of women who are scientists, engineers, technologists, and mathematicians to dispel prevailing stereotypes and biases. Following are the contributions of few remarkable women with STEM oriented careers that are role models for girls who show interest in STEM subjects.

Dr. Nergis Mavalvala is a Pakistani-American astrophysicist and a professor in Massachusetts Institute of Technology (MIT) who had discovered gravitational waves and quantum measurement science.[53] In 2010, she was also awarded MacArthur genius award. Dr. Atiya Khan is a Pakistani neuroscientist famous for her contributions in brain research, specifically on neuro-degenerative diseases like Parkinson and Alzheimer. Dr Sarah Qureshi is an aerospace engineer and CEO of private Pakistani aviation company, Aero Engine Craft. Currently, she is working on her project to create eco-friendly air engines.[54] Dr. Yasmeen Lari is a first female architect of Pakistan. She contributed in the preservation of architecture and heritage.[55] Azra Qureshi is a botanist who has increased potato yields by 5% and has received Norman Borlaug Award.[56] Ramla Qureshi is a structural and earthquake engineer who founded Women Engineers Pakistan (WEP). Her vision is to encourage women to participate in STEM subjects.[57] Maryam Sultana is first Pakistani female astrophysicist; while Talat Shahnaz Rahman is a condense matter physicist.[58] All these women are inspiration for women who are aspiring STEM subjects.

[50]Hollows, M. Rab, and C. Schulze, "Understanding Female Participation in STEM Subjects in Pakistan."

[51]Maryam Salman, "Empowering Women in STEM: Programs and Community Outreach Initiatives in Pakistan," October 2023, https://medium.com/@maryam.salman70/empowering-women-in-stem-programs-and-community-outreach-initiatives-in-pakistan-4c744596b678 [Accessed 27 Mar. 2024

[52]Ramla Qureshi, Nameerah Hameed, "Inspiring a New Generation of Pakistani Women Leaders in STEM," *World Bank Blogs*, 2019, https://blogs.worldbank.org/en/endpovertyinsouthasia/inspiring-new-generation-pakistani-women-leaders-stem [Accessed 1 Apr. 2024].

[53]MIT Physics. "Nergis Mavalvala PhD '97» MIT Physics." n.d. https://physics.mit.edu/faculty/nergis-mavalvala/

[54]Cranfield School of Management. "Dr Sarah Qureshi: Tackling the Biggest Environmental Issue You've Never Heard of!" ttps://www.cranfield.ac.uk/som/research-centres/bettany-centre-for-entrepreneurship/events-and-networking/dr-sarah-qureshi-tackling-the-biggest-environmental-issue-youve-never-heard-of [Accessed 31 Mar. 2024].

[55]Maryam Salman, "The Gender Gap in STEM: Challenges and Opportunities in Pakistan."

[56]Sadaf Sarfraz, "The STEM Gap — Contribution of Women in Science and Technology in Pakistan," https://scientiamag.org/the-stem-gap-contribution-of-women-in-science-and-technology-in-pakistan

[57]Ramla Karim Qureshi, "5, Women Engineers Pakistan (WEP), Pakistan," https://thedocs.worldbank.org/en/doc/944461603920639785-0310022020/render/5.WEPLoAsCOMPAug2020.pdf [Accessed 31 Mar. 2024]; Kamal Khanzada, "Ramla Qureshi - A Proud Civil Enginee," (n.d.), https://www.mizlink-pakistan.com/ramla-qureshi-a-proud-civil-engineer.html [Accessed 31 Mar. 2024].

[58]Sadaf Sarfraz, "The STEM Gap — Contribution of Women in Science and Technology in Pakistan," https://scientiamag.org/the-stem-gap-contribution-of-women-in-science-and-technology-in-pakistan

Government and non-governmental organizations should collaborate to create events and innovation summits to encourage women with STEM related careers. In addition, they should boost their confidence and interest by providing guidance, funding, trainings to develop skills and other relevant opportunities to initiate their own business. Simultaneously, industries should also play their role in cultivating opportunities for women in STEM careers by providing them internships and employment.[59]

Another hurdle in pursuing STEM is the lack of awareness regarding these subjects and their benefits. Sometimes it is often confused with stem cell theory as well.[60] Similarly, since very few people avail it there is very little empirical data and research so that it can maximize its reach.

One of the challenges in attaining STEM education is to devise pedagogy and trained teachers in a way as to keep engaging students. Reports show that many children get bored from math and Science at early age let alone pursuing them for higher degrees.[61] Therefore, in order to integrate STEM education, government should also invest in STEM focused schools, colleges and universities for women where especial guidance is provide to encourage the growth of women aptitude in STEM related field.[62] These institutes can also collaborate with non-governmental organizations to provide career opportunities as well internship programs to further gain the first-hand knowledge experience of STEM-related fields. Recently, University of Engineering and Technology (UET), Lahore has taken initiative to cultivate STEM interest of underprivileged students outside campus.[63] Such endeavors on both public and private sector can help to enhance interest in STEM subjects. Through the combined efforts of the government, policy makers and educators can help boost the confidence of women; and encourage families to let their daughters and wives pursue their interest in STEM education.

## 5. Application of Butler's Theory in Pakistani Setting

Although, we have seen in the essay that post-cultural theories like that of Judith Butler correlates with prevailing situation and scenario. It is interesting to note that by directly applying post-cultural theory, 'theory of performativity' in particular, to Pakistani education system will more likely be unacceptable for majority of people.[64] This is because a major proportion of Pakistani population is uneducated, orthodox and rigid in their religious and cultural rules. Amidst that, introducing a western approach by a western feminist will doom; and shall faces similar backlash as feminists in Pakistan have already faced.[65] Much of the criticism that feminists have faced is that feminists agenda is of Western nature which is trying to promote vulgarity that counters

[59]Awan et.al, "Interests and Recruitment in Science," 19–43.

[60]M. Sanders, "STEM, STEM Education, STEM Mania," *The Technology Teacher* 68 (2009): 20–26, https://vtechworks.lib.vt.edu/server/api/core/bitstreams/b5f37b87-c914-4e5a-8abc-f9b491dc2e36/content [Accessed 1 Apr. 2024].

[61]M. Sanders, "STEM, STEM Education, STEM Mania," *The Technology Teacher* 68 (2009): 20–26,

[62]Giddens, *Runaway World: How Globalization is Reshaping Our Lives*.

[63]S. M. Imaad, B. Wajid, I. U. Chaudhary, A. Sarwar, "Stem5: An initiative shaping the STEM narrative in Pakistan," (2016) *IEEE Integrated STEM Education Conference (ISEC)*, (2016): 156–161. https://doi.org/10.1109/ISECon.2016.7457522.

[64]Elizabth Adam St. Pierre, "Poststructural Feminism in Education: An Overview," *International Journal of Qualitative Studies in Education* 13 (5), (2000): 506. https://doi.org/10.1080/09518390050156422, https://www.appstate.edu/~jacksonay/rcoe/stpierreoverview.pdf

[65]A. Khan, "Pakistan: A Rising Women's Movement Confronts a New Backlash," *United States Institute of Peace,* (2021), https://www.usip.org/publications/2021/03/pakistan-rising-womens-movement-confronts-new-backlash.

Islamic values and culture of Pakistan.[66] Additionally, many people believe that feminist agendas are of political and western nature instead of humanitarian nature.[67]

Based on the aforementioned reasons, in my opinion, it is more feasible to use an approach of an eastern scholar with strong narrative built on religious arguments that are derived from Quran and Prophetic traditions in order to eradicate stereotyping and myths about gender roles. In this way, changing people minds for progressive society will be easier as they regard religion prior to everything else. This entails that although educationists can use Butler theory of performativity to understand and analyze the current problem as we have done in the essay; but for resolving it we need a sensitized approach that also caters to the belief system of Pakistan.

## 6. Closing Remarks

In Conclusion, need for women to opt STEM education is mandatory not only for their personal growth and breaking free from pre-ordained norms and stereotypes; but also for economic progress of Pakistan.[68] Although various Pakistani families, particularly in the province of Punjab and Sindh, are breaking free from universal patriarchy; and many parents as well as spouses are supporting women to pursue their goals.[69] But a large portion of women are still marginalized and face barriers while pursuing STEM subjects and relevant careers. There is a need to sensitize and encourage STEM trainings at school level for girls to participate in STEM disciplines.[70]

Judith Butler's theory of performativity totally relates to explaining gender disparity in choosing STEM subjects in Pakistan. The way roles of Pakistani women are stereotyped, constructed and performed can be analyzed through Butler's theoretical version of recurring performance and ritualization; identity subversion and resistance against it; Power and regulation; intersectionality and identity.[71]

The problem needs to be resolved on two fronts: 1) Challenging pre-existing traditions that have fixed rules to be abided by women; 2) putting conscious effort on both individual and state level to enhance the retention and enrolling of STEM fields for women. The essay successfully addressed possibilities as well as provided suggestions to enhance women interest in STEM education.

In addition, media should give due attention to the success stories of women in STEM fields. Likewise, the STEM role models should attend conferences and seminars to encourage other women to move beyond their hurdles and pursue their interests. Because despite government efforts, nothing can be changed until the pre-dominated patriarchal mind set is changed. As STEM oriented careers by Pakistani women would not only be beneficial for them to liberate them from stereotyping; but they can also address patriarchal societal challenges as well as enhance economic progress. This entails that "the equation for progress is simple: empower women in STEM, and

[66]A. Khan, "Pakistan: A Rising Women's Movement Confronts a New Backlash," https://www.usip.org/publications/2021/03/pakistan-rising-womens-movement-confronts-new-backlash.

[67]Elizabth Adam St. Pierre, "Poststructural Feminism in Education: An Overview," 506.

[68]Sadaf Sarfraz, "The STEM Gap — Contribution of Women in Science and Technology in Pakistan," https://scientiamag.org/the-stem-gap-contribution-of-women-in-science-and-technology-in-pakistan

[69]"National Report on the Status of Women in Pakistan, 2023," https://pakistan.unwomen.org/sites/default/files/2023-07/summary_-nrsw-inl_final.pdf.

[70]Giddens, *Runaway World: How Globalization is Reshaping Our Lives*.

[71]Judith Butler, *Gender Trouble: Feminism and the Subversion of Identity*, 150-185.

you empower nation with limitless possibilities".[72] In this era of advance technology and global competitiveness, Pakistan is in dire need to urge women to participate in STEM education; and encourage those who have already entered the mainstream STEM fields to retain their interest by providing them equal opportunities, wages and incentives. However, all of this should be achieve keeping in view the sensitive nature of people belief system and religion in particular.

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